SCIENCE

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VOLUME 111, NUMBER 2896

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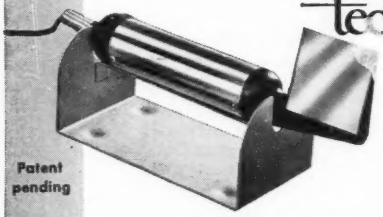

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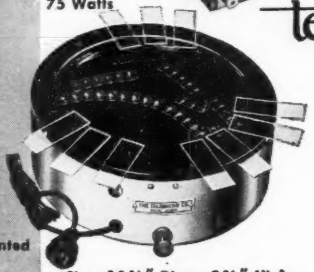

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SCIENCE

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Colloque International de Physique Theorique, Particules Fondamentales, et Noyaux: Paris, April 24–29

F. J. Belinfante

Department of Physics, Purdue University, Lafayette, Indiana

A COLLOQUIUM ON THEORETICAL PHYSICS was held at the Institut Henri Poincaré in Paris, April 24 to 29. At this conference, sponsored by the Centre National de Recherche Scientifique, various aspects of the theories of elementary particles were discussed. Among the many people participating or attending there were Ashkin, Auger, Bauer, Belinfante, Bhabha, Camerini, Casimir, DeBoer, DeBroglie, D'Espagnat, Destouches, Dirac, Feynman, Fierz, Glauber, Halban, Heitler, Hoang Tchang Fong, Iskraut, Janossy, Kallen, Kemmer, Klein, Kofoed Hansen, Leprince Ringuet, Møller, Pauli, Peierls, Proca, Rosenfeld, Serpe, Valatin, Wataghin, and Wouthuysen.

Of the most important subjects discussed, we mention here only a few. *Rosenfeld* reported on the limitations imposed on the measurability of electric charge and current densities. By using heavy elementary particles as test bodies, the charge distribution of electrons might be measured in regions smaller than the Compton wavelength.

Dirac reported on a new method of describing interacting particles. States were defined on parametrized hypersurfaces in space-time; ψ is considered constant if field variables for given parameter values u_1, u_2, u_3 on different hypersurfaces (different generalized time τ) are the same. There is one Schrödinger equation giving $\partial\psi/\partial\tau$; there are similar equations describing the change of ψ when the parametrization is changed, or, in the case of quantum electrodynamics, also when the gauge of the longitudinal part of the vector potential is changed. Further, expressions for canonical conjugates of field variables in terms of time derivatives of field variables are generally considered as auxiliary conditions or Schrödinger equations rather than as q-number relations. In this way, classical quantum electrodynamics can be quantized without use of Fermi's methods, and the Lorentz condition need not be imposed. The large numbers of Schrödinger equations thus obtained is finally reduced to only one by fixing the choice of the parametrization by making the charge density independent of τ, by considering the charge density as the canonical conjugate of a new variable ϑ and expressing the scalar potential in terms of $d\vartheta/d\tau$, thus avoiding the auxiliary condition expressing the vanishing of the canonical conjugate of the scalar potential, and by finally choosing ϑ as the time variable τ. As a consequence, the choice of hypersurfaces $\tau =$ constant is linked up with the gauge of the longitudinal vector potential, and a change of the gauge necessitates a change of the hypersurfaces.

Pauli reported on difficulties met when one tries to apply the method of renormalization of mass and charge to meson theory. He also discussed the method of regularization, by which meaningless (divergent) integrals may be avoided. One would like to consider the "*D*-functions" thus introduced as describing the action of actual particles of finite (large) mass rather than take their masses to infinite as it is now done for avoiding ambiguities. But the theory remains unsatisfactory, as charge renormalization cannot be avoided by it.

Kallen showed how one can obtain recent theoretical results just as well by use of Heisenberg's representation as by use of interaction representation.

Heitler discussed a theory proposed by Gupta and Bleuler for avoiding the inconsistencies in Schwinger's definition of the "photon vacuum" in quantum electrodynamics. By use of an indefinite metric for the calculation of matrix elements, it is possible to interchange the creation and annihilation operators for the "scalar" photons described by the scalar potential. Thus, Schwinger's covariant photon-vacuum definition gets a meaning. It is made consistent with the Lorentz condition by making the latter condition less rigorous, referring only to operators annihilating photons. It is hoped that this less rigorous Lorentz condition may be sufficient.

Belinfante stressed the disadvantage of the noncovariant definition of the "photon vacuum," which states only the absence of transverse photons. So-called proofs of the "equivalence" of this definition with the covariant one seem to be wrong. Application of Umezawa and Kawabe's guess at a covariant cut-off of the now divergent integrals in a future theory shows how the noncovariant definition of an electron without free photons leads to a noncovariant result for the electron self-energy. The question was discussed whether there would be any experimental method of detecting the small effects of the noncovariant terms on the properties of the electron. It seemed

best to make an accurate check of the theoretical formula for the Rydberg constant. (Note added: Birge has in the meantime shown that indeed such effects from noncovariant terms on the Rydberg constant do *not* exist. This would thus show the necessity of a new covariant definition of the photon-vacuum consistent with quantum electrodynamics.)

Feynman discussed the dualism between the "field" point of view and the "action at a distance" point of view in electrodynamics. An "integrovariational differential equation" was derived for the S-matrix describing the collision of a number of electrons in an external field in absence of free photons before and after the process. In this equation one of the D-functions occurs. Smearing out this D-function in order to avoid infinities gives a method of calculation, but does not lead to a consistent theory.

Rosenfeld reported on the nucleon-nucleon interaction, in particular on Blatt and Jackson's discussion of the low energy scattering cross sections and on the possibility of finding range and depth for an effective triplet state potential and for an effective singlet state potential separately. Both ranges can be made equal and a charge dependence of nuclear forces in the low energy region can be avoided by choosing a potential with sufficient tail at large r. For this purpose, an exponential well is just as good as a Yukawa potential, and the range of the potential fits nicely with the present mass of the π-meson, but square wells or Gaussian potentials would not work. With the correct potential-with-tail, the effect of tensor forces on low energy scattering can be considered as small.

The present data on the angular distribution in scattering can certainly not be explained by a pseudoscalar meson field alone. For the rest, relativistic effects should be particularly strong, by cross terms, when different couplings of a meson field with nucleons are combined. Pauli remarked that besides tensor forces a "spin-orbit" coupling may have to be taken into account.

Møller reported on the present ideas about the nature of π-mesons and μ-mesons. He mentioned some experimental evidence for the existence of neutral π-mesons, which rapidly disintegrate into a pair of gamma quanta.

Ashkin gave a report on new results obtained in this regard in Berkeley. The observed angular distribution of the gamma ray coincidences can be explained theoretically under the assumption that the gamma rays are emitted in a spherically symmetric way in the rest system of the neutral π-meson. The mass of the neutral π-meson is only slightly less than that of the charged π-meson. From measurements of the total intensities in the gamma spectrum for energies corresponding (a) to half the rest energy of the π-meson, and (b) to the entire rest energy of this meson, one can obtain some information about the nuclear coupling constants for the neutral π-meson.

Bhabha attempted to avoid the $1/r^3$ difficulty in the deuteron problem by deriving an exponential instead of a Yukawa potential for the proton-neutron interaction, from a new type of meson theory. He stressed that this theory was of a type not discussed by Pais and Uhlenbeck. *Feynman* pointed out that Bhabha's theory might lead to inconsistencies, if one considers the emission of real mesons, instead of the virtual meson field connected with the nucleon-nucleon interaction. *Casimir* remarked that the $1/r^3$ difficulty is not taken seriously in the magnetic dipole-dipole interaction of an electron, say with the nucleus, because r is large for these particles anyhow. Is a similar reasoning not possible in the deuteron problem?

Heitler discussed a simple theory of multiple meson production by high energy nucleons traversing nuclei. The energy spectrum of the cosmic ray primary nucleons is given. It is assumed that for each separate collision against a nucleon bound in the nucleus, only one meson is created, with an energy equal to a given fraction of the energy of the primary, as long as the latter energy lies above a certain critical value. About the same amount of energy is taken up by the recoil nucleon inside the nucleus. If this recoil energy is higher than the critical energy, this recoil nucleon also can start creating mesons.

Each primary traverses about two nuclei of the type considered before it slows down below the critical energy. The cross section for energy loss then decreases, and it will increase again at still lower energies, owing to ordinary scattering.

By use of statistics, the probability for creation of from 1 to over 30 mesons by one primary inside one single nucleus was calculated. The result is in nice agreement with experimental results obtained by counting the number of meson tracts in stars found in photographic emulsions.

D'Espagnat discussed the theory of meson production and compared it with the theory of Bremsstrahlung. He remarked that if a given fraction of energy goes into meson production in the center of gravity systems, this fraction is no longer constant in the laboratory system.

The last two days of the conference were used for reports on cosmic ray experiments and on the neutrinos.

The colloquium opened with a reception in the rooms of Unesco in Paris. It closed with a luncheon at the Cercle Interallié, where *Rosenfeld* expressed the gratitude of the foreign visitors for the excellent way in which this conference had been organized by the French hosts, and in particular by *Proca*.

Carl Emil Seashore, 1866–1949

Milton Metfessel
The University of Southern California, Los Angeles

THE PROFESSIONAL LIFE THEME of Carl Emil Seashore, who for three decades was head of the Department of Psychology and dean of the Graduate College at the State University of Iowa, was a wholehearted devotion to scientific methodology in both theory and practice. Within a life span of 83 years he made distinguished contributions as a psychologist to music, acoustics, art, child development, vocational guidance, and higher education. Some of his contributions were additions to the field of applied psychology, but quite as important was his imprint upon contemporary university life. He originated or took part in many movements whose results are now taken for granted.

As a member of that forthright and challenging group of department heads and university administrators who were pioneers in American psychology, he was qualified both by ancestry and childhood environment. He was born January 28, 1866, at Mörlunda, Sweden. He came to America as an immigrant at the age of three, shortly after the close of the war between the states. His forebears were long-lived, emotionally stable, deeply religious people of the land. For them there was neither poverty nor riches. His parents brought him to Boone County, Iowa, where they lived as vigorous pioneers, with periods of prosperity and depression, which they took in stride as their blessings and hardships. The effect on him of frontier life can be best summarized in his own words: "Resistance to the cold, struggle against the elements in every way was an opportunity for overcoming difficulties and feeling success. This kept our blood red and our muscles firm and our appetites good" (*1*).

The study of philosophy was his objective when he entered Yale University as a graduate student at the age of 26. George Trumbull Ladd was the guiding light of the department of philosophy, and he was sponsoring experimental psychology as developed by a brilliant and enthusiastic young Leipzig graduate, Edward W. Scripture. The situation as it was presented to Carl Seashore was one of sharp contrast between the approach to psychology of a philosopher and that of an experimentalist. He greatly admired the systematic writings and lectures of Ladd, and at first he found himself objecting to the remarks of Scripture about "armchair psychologists." The logically valid theories might indeed be factually correct, Scripture had maintained, but until they had been verified under controlled conditions they were secondhand. Not until Seashore felt a need for doing independent work did he gain the perspective that was to remain unchanged the rest of his life. In two episodes he found a key to the difference between the sponsors and founders of American psychology. Approaching Ladd with a proposal to investigate the subject of inhibition, he was referred to a completed account in Ladd's book. Scripture's response was quite different. "Try it," he said. "I date the birth of my scientific attitude from that moment," Dean Seashore wrote later (*3*). It is significant that he elected to remain under the stimulating influence of Scripture for two years of training after he received his doctorate at Yale in 1895.

Carl Seashore came to the State University of Iowa as an assistant professor of psychology in the fall of 1897. He rapidly won recognition for his capability and his willingness to accept responsibility. In 1902 he was appointed full professor of philosophy and psychology, in 1905 he became head of the department and in 1908 dean of the Graduate College, in which capacity he served with honor and distinction until 1937. In 1942 he was recalled as dean *pro tempore* and spent the war years at tasks he knew well.

He more than carried his share of the weight in the formative period of psychology at the turn of the present century. Then, as in his later adventures, he was on the front line: building a laboratory, constructing his own apparatus, performing significant experiments, demonstrating by results in specific situations, in short, developing operational definitions of what Scripture had called the "new" psychology. It was this work that was given national recognition in 1911, when Dean Seashore was elected president of the American Psychological Association. Ten years later he was chairman of the Division of Anthropology and Psychology of the National Research Council. From 1933 to 1939 he was chairman of the like-named division of the National Academy of Sciences.

As it was crystallized in Seashore's lectures, books, and activities, the new psychology was one of a specific attack on some definite problem in the daily affairs of human beings. The hypothetical solution to the problem was made explicit as a program, whose testing was controlled by the specifications of a correlated project. Experimentation (in the laboratory, with "brass instruments," if appropriate) was a pre-

requisite. This version of the scientific approach to problems of human behavior reached fruition in diverse fields through the work of Dean Seashore. It matched his pioneer background, his developed cosmopolitan interests, and his rigid laboratory training.

The down-to-earth problems culminating in his programs and projects were found in the course of his experience. He sought out difficulties, enjoyed the challenge that they meant to him, and expressed joy when his or others' efforts led to accomplishment.

Many of his programs can be traced to experiences in his youth. An example is his beloved psychology of music, which he inaugurated as a project in 1910 and which became his primary research interest for the rest of his life. At Gustavus Adolphus College, a Swedish Lutheran college in Minnesota, he was a leader in musical activities. He organized a choir of forty members who were so enthusiastic that they were willing to pay for rehearsals. He earned part of his expenses as a graduate student by his work as church organist. One of his friends, a musician, had repeatedly told him that he had an unusually fine musical ear. Dean Seashore decided to test this opinion and went to work adapting a set of tuning forks for the purpose. Thus began a series of experiments that were to culminate in the "Seashore Measures of Musical Talents" in 1919, books on the psychology of music, published in 1923 and 1938, and more than 100 articles on various phases of music. He was an enthusiastic evangelist for this new field and produced many variations on its themes, each new publication bringing in up-to-date experimental material. Apropos of his policy of repeated publications, he told a story about a minister who preached the same sermon for a number of successive Sundays. When called to task by church members, the preacher asked "Have you started to practice it?"

His projects for higher education, placement examinations, the discovery and motivation of gifted students, sectioning classes on the basis of ability, and independent project work in elementary psychology also had their sources in his early training. His arithmetic teacher did not understand fractions, and young Seashore found that "if you read all the rules carefully and work all the examples yourself, you will not encounter any difficulty" (*1*). In his sophomore year, his mathematics professor realized his boredom in class periods, and excused him from attendance on the provision that he would do the work by himself and pass a rigid examination. Dean Seashore expressed his indebtedness to both of these teachers, who each in his own way had taught him that there were students who were capable of independent work, who needed only guidance, and who were handicapped rather than helped by compulsory attendance at repetitious lectures. Out of these considerations came one of the tenets in his programs for higher education, that of "keeping each student busy at his natural level of successful achievement" (*1*).

In retrospect, many of the propositions in Dean Seashore's programs turn out to be simple, disarming assertions. They played the role of axioms in his thinking, and perhaps could be called truisms. Often they were shown to have practical consequences that were contrary to accepted or at least to going procedures. He made these consequences explicit by organizing projects correlated with his programs, the truisms, and their consequences. Such was his procedure in the early twenties, when he campaigned, under the sponsorship of the National Research Council's Division of Educational Relations, as a champion of the gifted student. He lectured and conferred with the faculties of some 140 universities. He would introduce the topic by acceptable statements such as that of keeping each student busy at his natural level of achievement. It was not until he elaborated what the program entailed that he stimulated the debates that he believed necessary for the success of the project, which became known as "Seashore's Fourteen Points." He had the pleasure of seeing most of these points put into action on his home grounds.

Numerous consequences of the proposition that individuals differ in various capacities and abilities were put up for practical testing in Dean Seashore's projects. He insisted that the first step was to measure these capacities and abilities. The second step was to compare the individual's performance in life situations with his rating in the tests. We now can see that Dean Seashore's approach to applied psychology was partly an emphasis upon the determination of conditions that are necessary but not decisive for behavioral consequences. His tests for musical talents measured ability to differentiate pitch, loudness, temporal intervals, etc. Without ability to differentiate pitch above a specified level, one cannot sing on key, but it does not follow that having such an ability, one can sing on key. The tests, then, were to be interpreted as the determination of limiting rather than causal conditions for given musical behavior. Ability to differentiate pitch, for example, was declared irrelevant to piano playing, and ability to discriminate loudness was taken as a necessary condition for musical touch. He rejected all "omnibus tests of musical talent," his phrase for a test of general musical talent. Such a test was for him not a solution of a problem but rather an area for the location of difficulties, and a challenge for sharply focused, tangible discoveries.[1]

[1] The same approach is found in the Meier-Seashore art judgment tests and the art project captained by Dr. Norman C. Meier.

Dean Seashore did not stop with the formulation of a program and project, but was active in initiating, maintaining, and containing them. Each project was an addition to the university's activities, and it is to his credit that no project was ever started without adequate provisions for housing, equipment, and personnel. Another feature of his planning was his method of matching the man to the job. He always found a trained or trainable young man in the psychology department to whom both responsibility and authority could be delegated for a specific project. His emphasis in training was on explicit understanding of scientific method, rather than on piecemeal learning or incidental transfer effects from performing experiments. In this way he placed in the hands of the young psychologists a powerful set of tools for the administration of the projects, so that they felt at home in directing research work integrating the subject matter of different sciences in applied fields: music, speech, child welfare, otology, physical education, and clinical psychology. He believed that no one subject had as high transfer value as an explicitly formulated scientific methodology, backed by illustrative exercises in the laboratory.

In his work with young psychologists, Dean Seashore applied what had held true in his own experience, that for effective work both responsibility and a free hand within the limits of the project should be given. There was an implied understanding of mutual loyalty and a within-the-family viewpoint on differences of opinion. In addition, he recognized the need for generous administrative overhead that would permit freedom from instructional duties not directly related to the project and freedom from any requirement to find immediate application for research results. These goals were realized to the greatest extent in the child welfare research project, led by George D. Stoddard after the death of Bird Baldwin.

The infusion of psychological research into the life stream of human events was Dean Seashore's ideal, even at the risk that the research might ultimately lose its identity with psychology. It was early evident to him that any practical problem of people was not one that can be solved on the basis of a single science. "Ask one question of nature, and nature will ask you ten," was one of his favorite quotations, and the questions asked by nature did not come marked as physics, biology, or psychology. He recognized an operational meaning of the unity of the sciences, and that was in part the ground for his projects that led to the breaking down of departmental barriers. In his training programs for graduate students he made provisions for courses by specialists in other sciences: acoustics, anatomy, neurology, etc. The course in acoustics was given by George W. Stewart, head of the Physics Department and a collaborator on the gifted student project. Fundamental in Dean Seashore's thinking was the premise that psychological theory, even though not formulated in terms of the concepts of other sciences, is controlled in part by those concepts. In other words, he believed that scientific theories, however verbalized and whatever the problems dealt with, should be harmonious. It happened that some of the questions asked by psychologists had not been considered by other scientists, but some kind of a reply in their terms was basic. One instance that reflected Dean Seashore's point of view was the stuttering project in the psychological clinic, under the direction of Lee Travis. The cerebral dominance theory of stuttering, although it was in the field of neurology, called for testing before the less rigidly formulated emotional theories; but it turned out to be highly restricted, and the field was left open for the latter theories. To Dean Seashore, this was just another example of the way in which science progresses by the elimination of originally plausible hypotheses.

Dean Seashore was alive to the necessity of operational controls, for which he made a number of operating rules. One was: Take one little thing at a time, step by step. Resist the tendency to dabble with a problem, spread it out too rapidly, and rush into publication. This rule is applied in his little book on elementary experiments in psychology, which led the field for twenty years.

Another operating rule in the translation of a program into a research project was, in his own terms, "never to count noses" (*3*). The immediate popularity of a project was irrelevant, and he made no attempt to be all things to all men. Fundamental research was dominant over service and instruction. The same battle was fought without compromise in nearly all of the projects.

It is clear why Dean Seashore placed so much emphasis in graduate training upon the pioneer concept of personal sacrifice in scientific work. (He made this principle the subject of an article in the October 1948 issue of the *American Psychologist*.) Each rule was a restriction, suggesting self-control. From his work in the laboratory on the Measures of Musical Talents, he developed an appreciation of the necessary disparity between the psychological vistas that he described so easily and vividly and the long and arduous work required for the verification of small crossroads in the complete panorama.

"We are in no hurry, we have all time," was one of his propositions that served to steady the highly motivated people who were responsive to outside pressures for immediate results (*1*). The slogan first appeared in Washington when he was chairman of the Division of Anthropology and Psychology in the third year of the organization of the National Research Council. Of the effect of the slogan he wrote (*1*): "This acted as a damper upon numerous efforts to give tone to the Council under the pressure of temporary and sporadic influences and gives some consolidation for the feeling that during those first years the Council was not accomplishing as much as it might." In other situations he ventured an even more general opinion—that beyond a dialectical point in pressure to accomplish, additional pressure results in a reversal of accomplishment. For the background of his attitude toward time, once more we look to his formative years. In his academy work at Gustavus Adolphus College, he recalled that "As a result of having to make the first two years of Latin in the academy under the 'stick' of a teacher, Latin failed for me" (*1*). It was with a different kind of a stick that Dean Seashore found an antidote for overconcentration on problems, and his golf game was remarkable even in later years. He rarely talked shop on an afternoon off.

The "rising scale" about which he often spoke in connection with the life of psychologists also describes his professional output (*3*). The number of publications, starting in 1893, in units of ten-year periods, increased up to the time when he returned to administrative duties during the last war. His greatest yearly output began in 1937, the year following his appointment as dean emeritus. A small proportion of his contributions are found in the standard psychological journals. When he wrote on a subject of interest to several sciences, he published his work in *Science* and *The Scientific Monthly*. Other contributions were made directly in the channels of the field to which psychological methods were applied. The terminology he used was often a compromise between that of psychology and the related fields, either basic or applied. His style was lucid and affirmative, and in his nontechnical writing he used the first person with conversational freedom. He described his programs as potentialities and challenges for research, writing from the point of view of an administrator who was close to the operating states of affairs. It was not until his later years that he took cognizance of technical misunderstandings of his writings. In 1942 he wrote of his program for the psychology of music: "These statements do not mean that psychology has accomplished all these things, but rather that the way has been paved" (*2*). He cooperated with the public press, and welcomed interviews with newspapermen on programs, projects, and specific studies.

Dean Seashore regarded the handling of graduate students' personal problems as a primary part of his work as dean. He was quick to recognize a problem and took the initiative in bringing it out into the open. At the same time, where a project was involved it came first, and personal difficulties were to be solved without any change in the work. In other contexts this might have been an unsuccessful approach, but in the setting of all the other adequate provisions for the testing of the programs it was quite feasible.

In his programs graduate students were encouraged to construct their own makeshift apparatus. Dean Seashore designed or collaborated in the design of many pieces of original apparatus: a tonoscope, a loudness audiometer, the Iowa pitch range audiometer, phonophotographic apparatus, the Iowa piano camera (with Joseph Tiffin), to mention the more important ones. Emphasis was on simplicity and adequate controls, and looks did not count.

The training of graduate students in the psychology department, then, was highly specialized in terms of a problem in an applied field, such as music, speech, otology, and education, and the problem was approached by coordination of psychology with basic sciences. The training was generalized in terms of scientific methodology. An interesting consequence was the frequency with which the graduates were offered positions throughout the country in both applied and basic subjects. When Dean Seashore relinquished his departmental headship, Iowa's Department of Psychology had become one of the leaders in numbers of Ph.D.'s granted, but as a result of the cosmopolitan training, many graduates in their professional pursuits found themselves in a somewhat ambiguous relation with psychology proper. Some of Dean Seashore's students struck out for themselves—the most distinguished men of this group are Walter Miles and Daniel Starch.

One of his sons, Robert, has followed his trail and is chairman of the Department of Psychology at Northwestern University (*2*). Carl, Jr., is a professor of engineering. The career of Marion was tragically cut short when he died in attempting to save a friend from drowning. His talented and kindly wife, Roberta Holmes, whom he married in 1900, died two months before Dean Seashore's death, which occurred on October 16, 1949, at the home of his son, Sigfrid, an attorney in Lewiston, Idaho.

Some of us were fortunate to be close enough to him to share a few of his hardships and blessings. Our appreciation of the man and his works increased

steadily through the years. He helped others far more than others helped him.

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Technical Papers

An Agglutinin in Normal Sera for Periodate-treated Red Cells[1]

Merwin Moskowitz[2] and Henry P. Treffers

Department of Bacteriology,
Yale University School of Medicine,
New Haven, Connecticut, and
The Blood Grouping Laboratory of Boston,
Boston, Massachusetts

In confirmation of the observation of Burnet (*1*), we found that periodate ions rendered red cells panagglutinable. We have extended this finding with the observation that the agglutinin for periodate-treated red cells (PTC) is distinct from the agglutinin for red cells rendered panagglutinable by the filtrates of cultures of *Vibrio comma* (VTC) (*11*). Experiments demonstrating the specificities of these agglutinins are presented and the significance of the finding is discussed.

Saline-phosphate buffer at pH 7 (*9*, p. 104) was used as a diluent and washing medium. Two percent suspensions of washed human red cells were treated with an equal volume of 0.001 M potassium periodate (in buffer) for 30 min at room temperature. The cells were centrifuged and washed three times with volumes of buffer each equal to four times the volume of the original cell suspension. The washed, treated cells were made up to a 1% suspension for testing. This procedure of treating the red cells with periodate permitted the maximum action of the periodate with minimum damage to the cells. Little or no hemolysis occurred with this treatment, whereas longer treatment or the use of more concentrated periodate solutions caused extensive hemolysis without increasing the panagglutinability of the treated red cells. *Vibrio comma* (Strain 4Z)[3] was grown in 2% Trypticase[4] broth (plus 0.5% sodium chloride) for 20 hr at 37° C and then passed through a fritted glass sterilizing filter. The red cell suspension was treated with the filtrate in the same manner as with the periodate, except that the mixture stood 1 hr at room temperature. No increase in the panagglutinability of the red cells was observed if the enzyme acted on them for a longer time at room temperature or at 37° C.

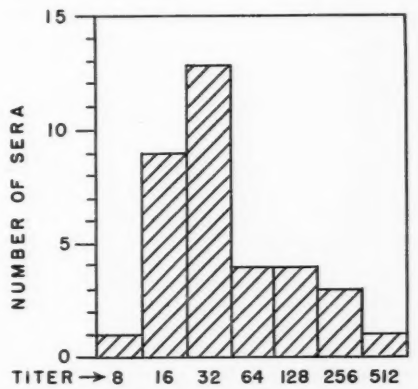

FIG. 1. Periodate agglutinin titers 35 normal human sera. sera.

PTC were agglutinated by all adult human sera tested. PTC were also agglutinated by their own serum. Two drops of the treated cell suspension were added to two drops of twofold serial dilutions of serum and, after standing at room temperature for 30 min, the mixture was centrifuged for 30 sec at 2,000 rpm on a clinical centrifuge. The tubes were gently rotated to dislodge the agglutinates and then read; the highest dilution of serum which gave macroscopic agglutination, e.g., many large clumps with few free cells, was considered the end point. Thirty-five sera from apparently normal individuals were tested with PTC and the results are presented in Fig. 1. Type O cells were used; the untreated

[1] After this article was submitted it was learned that F. S. Stewart (*10*) also noted the difference between periodate and T agglutinins. Since the article was written it has been found possible to render red cells agglutinable by filtrates of cultures of *Staphylococcus aureus, S. albus,* and *Streptococcus pyogenes.* Cells treated with *S. aureus* filtrates were agglutinated by all sera tested; those treated with *S. albus* and *S. pyogenes* filtrates were agglutinated by most, but not all sera. The agglutinin for cells treated with *S. aureus* filtrates is different than the periodate or T agglutinin; the one or more agglutin for cells treated with *S. albus* and *S. pyogenes* filtrates appear to be related to the others in a manner that is not understood at the moment.

[2] Public Health Service Postdoctoral Research Fellow of the National Heart Institute.

[3] We wish to thank Dr. B. A. Brody for this culture.

[4] Baltimore Biological Laboratories.

TABLE 1

RESPONSE OF RABBITS TO INJECTIONS WITH PERIODATE-TREATED CELLS (PTC), CELLS TREATED WITH *Vibrio comma* ENZYME (VTC), AND NORMAL CELLS (NC)

Rabbits	Sera			Titer with:		
				PTC	VTC	NC
I and II	Before injection:		I	32	128	16
			II	32	128	16
	After injection with PTC:	unabsorbed	I	7,500	500	500
			II	10,000	500	500
		absorbed	I	5,000	< 100	< 100
		with VTC	II	10,000	< 100	< 100
		absorbed	I	7,500	200	< 100
		with NC	II	10,000	200	< 100
III and IV	Before injection:		III	32	256	16
			IV	64	512	64
	After injection with VTC:	unabsorbed	III	2,500	15,000	2,500
			IV	2,500	10,000	2,500
		absorbed	III	< 100	10,000	< 100
		with PTC	IV	< 100	10,000	< 100
		absorbed	III	< 100	10,000	< 100
		with NC	IV	100	10,000	< 100
V and VI	Before injection:		V	64	256	16
			VI	16	128	8
	After injection with NC:	unabsorbed	V	2,500	7,500	7,500
			VI	2,500	10,000	10,000
		absorbed	V	< 100	500	1,000
		with PTC	VI	< 100	500	5,000
		absorbed	V	100	< 100	2,500
		with VTC	VI	100	< 100	5,000
		absorbed	V	100	200	< 100
		with NC	VI	100	200	< 100

cells were not agglutinated by the sera at room temperature. Periodate treatment had no effect on the ability of Type A or Type B red cells to agglutinate with their specific agglutinins but it apparently destroyed the Rh (D) factor, as Rh-positive PTC did not agglutinate with agglutinating Rh antiserum in saline or with incomplete Rh antiserum in albumin. Before testing for the specific agglutinins, the agglutinin for PTC was absorbed from the sera mentioned. It has previously been shown that VTC agglutinate with A, B (*4*), and Rh (*11*) antisera.

Human sera having a titer of 8 to 32 for PTC and VTC were absorbed with an equal volume of packed PTC for 15 min at room temperature and the sera still agglutinated VTC to the same extent, but no longer agglutinated PTC. After absorption with VTC the sera still agglutinated PTC to the same extent but no longer agglutintaed VTC. The specific absorption of the agglutinins for PTC and VTC was also demonstrated with sera from sensitized rabbits (Table 1).

Heating dissociated the agglutinins from sensitized cells as it does in the Rh (*5*) and other systems (*7*). Six percent suspensions of VTC and PTC were mixed with two volumes of serum and, after standing at room temperature for 15 min, the cells were centrifuged and washed three times at 0° C. The packed cells were mixed with an equal volume of buffer, heated at 56° C for 5 min, and centrifuged. The supernatant fluid from sensitized VTC agglutinated only VTC, and the supernatant fluid from sensitized PTC agglutinated only PTC. Neither supernatant fluid agglutinated normal cells.

Rabbits were injected with normal cells, PTC and VTC. One ml of a 25% cell suspension was injected into the ear veins on two successive days. After a lapse of 10 days the rabbits were injected intraperitoneally and then intravenously the next day. Seven days after the last injection they were bled. The sera were absorbed as described except that 100-fold dilutions of the sera were used. The results are tabulated in Table 1. It is observed that the agglutinin titers for PTC and VTC were increased as a result of the injections and the increase was specific for each type of treated cell. These experiments indicate that the agglutinin for PTC is not the same as the one acting on VTC and that it has the characteristics of an antibody, e.g., the agglutinin titer of the sera could be increased with PTC. This will be referred to as the periodate agglutinin.

Thomsen (*12*) observed that the red cells in some contaminated bloods were agglutinated by all sera, and in an extensive study of this panagglutination phenomenon Friedenreich (*4*) showed that it was an enzyme produced by the bacteria that rendered the red cells panagglutinable. He found that only a few organisms, among them several strains of *Vibrio comma*, produced this effect. The agglutinin for the treated cells, called the T agglutinin, could be absorbed from the serum by red cells treated with the filtrates from cultures of a number of bacteria which he tested in this respect. Burnet and Anderson (*2*) showed that rabbits could be specifically sensitized to VTC, and conjectured that the T agglutinins may be involved in the pathogenesis of various diseases such as blackwater fever. Some viruses also render red cells panagglutinable (*11*), and studies

(*8*) were made of the T agglutinin titer of patients with various virus diseases. A significant rise in T agglutinin titer was observed only in patients with primary atypical pneumonia. These workers were observing only the T agglutinin; but, as has been shown here, there is more than one panagglutinin in sera and the panagglutinin titer for cells such as PTC may be increased without being detected if only the T agglutinin is observed.

It is possible that agglutinins for altered red cells are implicated in the pathogenesis of various diseases and, for instance, may sometimes be the cause of intravascular agglutination ("sludged blood" [*6*]). However, as there may be many different agglutinins acting on cells altered by different agents, these agglutinins would not be observed if the sera were tested with cells altered by a single agent. As an example, the tubercle bacillus may form an enzyme which alters some of the infected host's red cells and these altered red cells could then serve as antigens, having become "foreign" to the body. The antibodies produced against these altered cells may then act on other altered cells, causing intravascular agglutination. The agglutinins produced in such cases need not necessarily be panagglutinins, since they may agglutinate only red cells altered by the specific agent. In this hypothetical case, the specific agent is an enzyme produced by the tubercle bacillus, and thus the agglutinin for red cells altered by this agent may be found only in individuals suffering from tuberculosis. If a specific altering agent was produced by an organism such as the staphylococcus, the agglutinin acting on red cells altered by this agent may be found in all sera, due to the staphylococci normally present in the body, but it may increase in titer in individuals with staphylococcal infections. It is conceivable that an endogenous abnormal enzyme system may also produce the general picture described here.

Friedenreich (*4*) tested most of the common bacteria for the ability of their culture filtrates to render red cells panagglutinable, but found that only a few were able to do so. However, Chu (*3*) recently found that filtrates of the cultures of many common bacteria did render red cells panagglutinable. Chu did not describe the manner in which he grew his organisms, and differences in the media and conditions of growth may explain the differences in their results. He also did not report any cross-absorption studies to see if different agglutinins were responsible for the agglutination in the various cases. The organism with which Friedenreich did most of his work produced active filtrates only if it was grown at 22° C; the filtrates were inactive if the organisms were grown at 37° C. In this laboratory and in other laboratories (*11*) active filtrates are routinely obtained when the organisms are grown at 37° C. Thus the conditions necessary for the production of active filtrates probably vary with different organisms. Studies are under way in this laboratory on the ability of filtrates of cultures of pathogenic bacteria grown under various conditions to render red cells agglutinable by normal sera and by sera from patients with infections caused by the specific bacteria.

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Reduction of Mortality from X-Radiation by Treatment with Antibiotics[1]

C. Phillip Miller, Carolyn W. Hammond, and Marianne Tompkins

Department of Medicine and the Institute of Radiobiology and Biophysics, University of Chicago, Chicago

A preceding communication (*1*) presented results of blood and spleen cultures on mice subjected to a single exposure of 600 or 450 roentgen units total body x-radiation. The results showed an incidence of bacteremia which rose and fell during the second postirradiation week roughly parallel with the daily death rate. This finding suggested that infection might be a significant factor in death from radiation injury. An attempt, therefore, was made to reduce the mortality from x-radiation by controlling the bacteremia by the administration of antibiotics. As the bacteremia was found to be caused by microorganisms (mostly Gram-negative bacilli) normally inhabiting the lower intestinal tract of these mice, it was realized that to be effective an antibiotic must be active against a wide variety of bacterial species.

Methods. Male Swiss mice were exposed to a single dose of 450 r x-radiation delivered at 20 kv, 15 ma, at a distance of 27 in., using ½-mm copper and 3-mm Bakelite filter.[2] The dose rate was approximately 20 r per min. Their LD_{50} (30 days) was about 400 r.

After irradiation, they were divided into control and treated groups, so that each therapeutic trial contained a group of control mice that had received the same dose of irradiation on the same day. From the 4th to the 28th day after irradiation, the treated mice were injected

[1] This investigation was initiated as part of the U. S. Army Contract No. W39-007-MD-425 and has been continued under Contract No. At(11-1)-46 between the U. S. Atomic Energy Commission and the University of Chicago.

[2] Most of the mice were irradiated at the Argonne National Laboratory with the assistance of Mr. Joseph Trier and Mr. Emil Johnson. Some were irradiated by Dr. James W. J. Carpender of the Section of Roentgenology, Department of Medicine, University of Chicago.

subcutaneously with 0.5 ml of saline containing the antibiotic[3] in the doses indicated in Table 1. Control mice received daily injections of 0.5 ml saline subcutaneously for the same period of time.

TABLE 1

EFFECT OF ANTIBIOTIC THERAPY ON THE MORTALITY OF MICE EXPOSED TO 450 R X-RADIATION

Drug	Dose	Animals irradiated	% Dead at 30 days
Streptomycin	6,000 μg	128*	16
Controls†	.....	127*	81
Streptomycin	5,000 μg	101*	34
Controls†	.....	101*	89
Streptomycin	7,000 μg	88‡	30
Controls†	.....	88‡	77
Penicillin	10,000 units		
Streptomycin plus ...	5,000 μg	72‡	25
Controls†	.....	72‡	66
Chloramphenicol	2.0 mg	47‡	36
Controls†	.....	45‡	60

* Total in 3 experiments.

† Control mice were injected subcutaneously with 0.5 ml saline daily for the same period—24 days.

‡ Total in 2 experiments.

Results. The results, presented in Table 1, show that streptomycin administered subcutaneously once a day from the 4th through the 28th day after irradiation significantly reduced the mortality during the 30-day period of observation. In the group treated with 6,000 μg of streptomycin, 16% died, as compared with 81% of the controls. Doses of 5,000 and 7,000 μg of streptomycin showed less striking but still significant degrees of protection.

The group treated with a combination of 5,000 μg of streptomycin and 10,000 units of penicillin had a 30-day mortality of 25% compared with 66% for the controls.

Preliminary trials with other antibiotics have shown chloramphenicol (chloromycetin) to be somewhat less effective than streptomycin alone or in combination with penicillin. Chloramphenicol, as well as aureomycin, caused a considerable degree of irritation at the site of the injection. In some of the mice there was even necrosis of the skin. These deleterious effects are being obviated in current experiments in which the drug is administered in food.

Polymyxin B in doses of 0.2, 0.1, 0.05, and 0.02 mg failed to reduce the mortality. In fact, the death rate was increased by the larger dose, presumably because of its toxicity.

Results with aureomycin were irregular. One experiment showed a significant reduction in mortality but another experiment showed none, probably because infection with a strain of *Pseudomonas aeruginosa* insensitive to aureomycin appeared among the mice in that group.

[3] The streptomycin and polymyxin were provided by Chas. Pfizer & Co.; the penicillin by Commercial Solvents Corporation, Eli Lilly & Co., and Schenley & Co.; the aureomycin by Lederle & Co.; the chloromycetin by Parke-Davis & Co.

It seems evident, therefore, that, to be effective in reducing mortality from irradiation injury in mice, a chemotherapeutic agent must provide protection against infections by bacteria normally present in the animal, and also against all pathogens which might establish themselves within its body during the period when the animal's natural resistance to infection is markedly reduced. Among the antibiotics tested, streptomycin has provided the most effective protection.

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New Chemotherapeutic Agents in Enterohepatitis (Blackhead) of Turkeys

E. Waletzky, J. H. Clark, and H. W. Marson[1]

Chemotherapy Division, American Cyanamid Company, Stamford, Connecticut

The need for an economical chemotherapeutic agent for the treatment or prevention of enterohepatitis (blackhead) of the turkey and chicken encouraged the trial in enterohepatitis of compounds with suppressive activity in other protozoan infections. It seemed desirable to test a large variety of such agents in view of the wide taxonomic gap between *Histomonas meleagridis* and other pathogenic protozoa, and the generally limited correlation between activity in different protozoan infections, e.g., malaria and coccidiosis (*4*). Twenty-four compounds of 17 different structural types active in experimental cecal coccidiosis (*Eimeria tenella*) of the chicken, mainly at somewhat toxic or at uneconomically high concentrations (*5*), and six types of antimalarials were tested in young infected turkeys by the drug-diet method. Standardized enterohepatitis infections were obtained by the rectal inoculation of homogenates from livers with freshly formed lesions.

A high degree of suppressive activity in enterohepatitis at nontoxic diet concentrations was shown only by 2-amino-5-nitropyrimidine (*3*) (Enheptin-P),[2] a compound with a moderate degree of anticoccidial activity at slightly toxic concentrations in the chicken (0.15%). On the other hand, such highly active anticoccidials as the sulfanilamide derivatives or nitrophenide, and such antimalarials as chloroquine or chlorguanide, as well as the 18 other types of compounds tested, were inactive. 2-Amino-5-nitropyrimidine almost completely prevented mortality (12%) and the development of cecal and liver lesions in 164 birds when 0.1% concentrations of drug in the diet were given for 7 to 14 days and when treatment was begun not later than 3 days after rectal inoculation. The 215 untreated controls in these 13 tests suffered 80%

[1] The assistance of C. O. Hughes in the early phase of the biological work, and of M. C. Brandt, A. Bliznick, and S. Brackett in its later phase, is gratefully acknowledged.

[2] Enheptin-P is a trademarked product.

mortality at an average of 11 to 12 days after inoculation. Drug concentrations as low as 0.0375% in the diet for 14 days after inoculation prolonged survival time considerably. Enheptin-P was also highly active in enterohepatitis produced by the oral inoculation of *Heterakis gallinae* ova, which is the presumptive major mode of naturally occurring infections.

Accordingly, a large number of related heterocycles were prepared (J. H. Clark and H. W. Marson) of which the most promising, 2-amino-5-nitrothiazole (*1, 2*) (Enheptin-T)[3] may be equally active and can be produced

TABLE 1

THE EFFECT OF ENHEPTIN-T* (2-AMINO-5-NITROTHIAZOLE) ON ENTEROHEPATITIS OF TURKEYS PRODUCED WITH *Heterakis gallinae* OVA

Days treated†	% Drug in diet	No. alive/total‡		Days survival§	
		Treated	Control	Treated	Control
1–15 B	0.10	7/7	3/10	..	18
1–15 B	0.05	9/9	3/10	..	18
3–17 A	0.15	8/8	1/8	..	17
4–18 B	0.10	7/10	3/10	31	18
4–18 B	0.05	4/10	3/10	28	18
5–19 A	0.15	5/8	1/8	32	17
7–21 B	0.10	4/9	3/10	34	18
7–21 B	0.05	2/10‖	3/10	30	18
13–21# C	0.10	1/5**	2/10	25	14
13–21# and 21–28 B	0.15 and 0.05	6/10	3/10	41	18

* Enheptin-T is a trademarked product.

† Single oral inoculation with about 300 *Heterakis* ova at 0 days in tests A, B, and C.

‡ Seven weeks after inoculation in A, 8 weeks in B and C.

§ Average of dead birds only.

‖ Two deaths during treatment. All other deaths except ** after treatment stopped.

Treatment begun when clinical symptoms appeared in group.

** One death during treatment.

much more economically than Enheptin-P. In eight experiments with 96 rectally inoculated poults treated with 0.035% or 0.05% of Enheptin-T for 14 days, the average prolongation of survival time by 10 to 15 days was at least as great as that obtained with Enheptin-P. Although two weeks of treatment with 0.1% (81 birds) or 0.05% (116 birds) of the thiazole compound did not reduce delayed mortality (after treatment halted) as much as similar Enheptin-P treatments, this may only reflect the lower control mortality of the latter tests. In any event, 0.05% of Enheptin-T suppressed mortality completely during treatment, and for more than one week after treatment halted, in rectally inoculated birds treated for 4 weeks (15 birds), for 6 weeks (11 birds), for 8 weeks (15 birds), or for 12 weeks (14 birds). This indicates the efficacy of 0.05% for long term, continuous treatment. Such treatment, or repeated intermittent treatments, may prove necessary in the field with either of these drugs, since substantial, acquired immunity to severe experimental challenges was absent in drug-treated survivors of experimental infections. (However, our data do not exclude the possibility that such immunity may follow repeated exposure to infection, or may be adequate with the lighter challenges that probably occur in the field.)

Enheptin-T is highly active in enterohepatitis produced with *Heterakis* ova (Table 1). Complete prevention of mortality was obtained when 14 days of treatment was begun not later than 72 hr after a single oral inoculation. With treatments begun later, there was generally some reduction in mortality, and very few deaths occurred until more than one week after treatment stopped, even when treatment was not begun until the appearance of clinical symptoms (13 days). This suggests that longer treatments might have saved most of the birds. The activity of Enheptin-T, and of Enheptin-P, has been confirmed by others in naturally occurring field outbreaks and will be reported elsewhere, as will full details of the above results.

[3] Enheptin-T is a trademarked product.

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Effect of Adrenalectomy on Liver Catalase Activity in the Rat[1]

R. W. Begg and E. F. Reynolds

Cancer Research Laboratory,
Department of Biochemistry,
Dalhousie University, Halifax, Canada

Adrenal cortical secretions have been shown to influence enzyme activity, both by removal of the adrenals and by injection of adrenal cortical extracts (*4, 5*). It has been demonstrated that cytochrome oxidase is diminished in activity by adrenalectomy of the rat (*7*).

In connection with studies on liver catalase activity in normal and tumor-bearing rats, we needed to know whether adrenalectomy could alter liver catalase activity. Accordingly, Sprague-Dawley-Holtzman rats of both sexes were adrenalectomized by the lumbar approach under aseptic conditions. The animals were maintained postoperatively at a constant temperature on a diet high in sodium and low in potassium (*1*). Control rats were maintained in the same environment and on the same diet, but given tap water. The rats were sacrificed 14–21 days after adrenalectomy and liver catalase activity was determined by a titrimetric method (*2*).

The results are presented in Table 1, from which it is evident that adrenalectomy decreases liver catalase activity in the rat. Though a sex difference in liver catalase activity has been reported (*6*), it was not noted in

[1] Aided by grants from the Banting Research Foundation and the National Cancer Institute of Canada.

TABLE 1

LIVER CATALASE ACTIVITY IN THE RAT

	No. of rats	Body wt in g	Catalase activity ($K \times 10^4$)	P*
Control	6	215 ± 28†	2418 ± 114	....
Adrenalectomized ..	8	189 ± 14	1781 ± 251	< 0.05

* P in t test of Fisher.
† Standard error of the mean.

this or other investigations (*3, 8*). The possible role of strain differences in this discrepancy is not known.

It is improbable that inanition was a factor in the loss of liver catalase activity (*6*), since the animals operated upon continued to gain weight (60 g in 21 days), and in both groups the extracts of liver were adjusted to constant nitrogen content (0.2 mg N/ml).

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An Apparatus for Localizing Warm and Cold Receptors

W. W. Tuttle and C. D. Janney

Department of Physiology,
State University of Iowa, Iowa City

Ever since Blix (*1*), Goldschneider (*3*), and Donaldson (*2*) discovered that cutaneous receptors are not distributed uniformly over the surface of the body, but are present as discrete points, laboratory experiments have been devised to demonstrate this fact. Numerous types of equipment have been employed for the purpose of making charts of the distributions of cold and warm points in various regions of the skin. These vary from metal tubes arranged so that water of any desired temperature can be circulated through them to glass and metal rods placed in water and sand baths.

In order to provide a better means for locating cold and warm points on the surface of the body, a new type of apparatus has been devised and is herewith described.

Localization of cold points. The apparatus devised for the localization of cold points is shown in cross section in Fig. 1. It consists of a plastic cylinder (*C*) 2½ in. long by 1¾ in. in diam. A plastic cap (*A*) cut from a rod, and fitted with a gasket (*B*) is made to screw into one end of the cylinder, thus sealing it. A plastic tube (*D*) 3½ in. long, with an inside diameter of ⅜ in. is cemented into a plastic disk, which in turn is cemented into the open end of the plastic cylinder (*C*). A copper fitting (*E*) milled to a point 1 sq mm is threaded and cemented to the free end of the ⅜-in. tube.

The technique for locating cold points is to place an ice cube in the large cylinder together with sufficient water to fill the small tube. The cylinder is tipped and then righted so that the water is cooled by flowing over the ice. When the apparatus is righted, the cold water enters the small cylinder thus cooling the copper tip, which is kept at a uniform temperature of approximately 10° C by tipping the apparatus occasionally.

The experimental procedure for locating cold points is to survey the area in question with the copper tip and to have the subject report "cold" when a cold receptor is contacted.

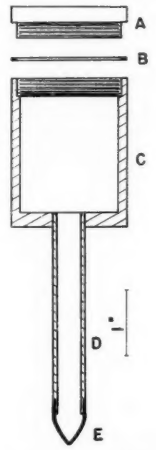

FIG. 1. Apparatus for localizing cold receptors.

Localizing warm points. The apparatus for localizing warm receptors is shown in Fig. 2. It consists of a 22.5-watt Ungar soldering pencil (obtainable from any radio supply company) connected in series with a 3000-ohm, 2-watt potentiometer (R_1) and a 1500-ohm, 5-watt fixed resistor (R_2). The potentiometer and resistor are contained in a small box made of sheet metal. The box is lined with insulating paper (not shown) and is held together by a screw from the back into post (*A*), which in turn is soldered to the front. A chassis mounting type plug (*B*) which fits a standard 110-volt receptacle is placed in the back of the box. Care must be taken either to employ a potentiometer in which the contact arm is insulated from the control shaft or to insulate the shaft from the box and to provide it with an insulating knob so as to prevent any contact between the fingers and the shaft. Otherwise there is danger of electric shock to the experimenter.

S

V

W

X

Y

Z

The copper end of the soldering iron is beveled to a point 1 sq mm in area. The potentiometer provides for point temperatures from 39° C to 85° C. Since the temperature of the skin serves as the zero point, 39° C should serve to localize warm receptors. However, experience has shown that 44° C serves the purpose best. To obtain this temperature on the particular instrument constructed by the authors the potentiometer is set at a dial reading of 4, which means that about 1,800 ohms of the potentiometer are in the circuit. At any rate, the point temperature can be varied to meet the experimental demands by changing the resistance in the potentiometer, to reach the desired temperature.

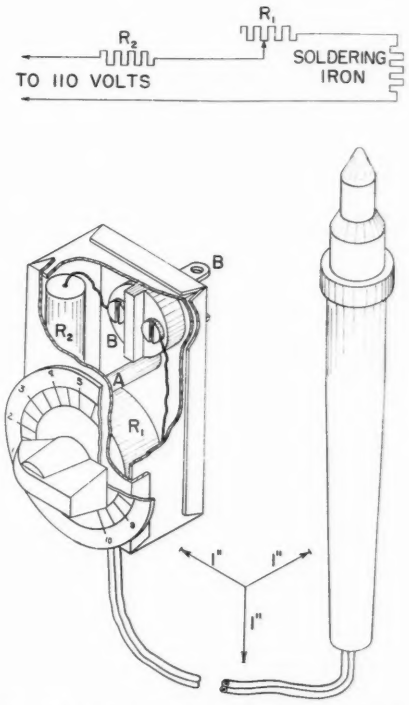

FIG. 2. Apparatus for localizing warm receptors.

The apparatus just described, for the localization of cold and warm receptors, is also suitable for applying cold and heat to any localized area where it is desirable to show the effect of temperature changes on activity. The equipment is effective, readily controlled, and inexpensive. Its simplicity of construction is advantageous in that it can be made available for any laboratory with limited shop facilities.

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Hemophilia in the Female Dog[1]

Kenneth M. Brinkhous and John B. Graham[2]

Department of Pathology, School of Medicine, University of North Carolina, Chapel Hill

The inheritance of true hemophilia as a recessive sex-linked characteristic is well established. Genuine cases of this disease appear to have been observed in the male sex only. However, the disease would be expected in females from matings in which both parents could contribute X chromosomes containing the affected gene *h*. Marriages between hemophilic males (X_hY) and females heterozygous for the disease (X_hX_H) are believed to have occurred on rare occasions. Apparently, true hemophilia did not appear among the female progeny. This lack of hemophilia in the female has been the subject of speculation for decades, and has led to several alternate hypotheses, including the following: (a) the hemophilic gene is sublethal, and a double dose of the gene, such as would be present in a female hemophiliac, is lethal; (b) the genotype X_hX_h may occur, but the bleeding tendency is not manifest in females; and (c) the opportunities for the appearance of hemophilic females have been too limited to determine whether or not this genotype can occur.

Recently a bleeding disease in male dogs was described in which a sex-linked type of inheritance was demonstrated by matings between females, heterozygous for the disease, and normal males (*2*). Extensive studies showed that the clotting defect in the canine disease was indistinguishable from that in human hemophilia (*3*). The untreated bleeders usually died of massive hemorrhage early in life. By frequent transfusions of blood or plasma the hemorrhagic phenomena were controlled, and the bleeder males were reared to maturity.

The purpose of this study was to test the results of mating these bleeder males with females heterozygous for the disease. From such a mating, half of the males should be bleeders. Likewise, half of the females should be bleeders, provided that the disease can exist in this sex. The results of these matings are shown in Table 1. Ten of the 19 female pups tested proved to be bleeders. This was as close to the theoretical expectation of a 1:1 ratio as was possible. In the males, the preponderance of nonbleeders over bleeders, 14 to 8, appears, on application of the chi-square test, to be merely a chance deviation from the expected 1:1 ratio ($\chi^2 = 1.64$; $n = 1$; $P = 0.2 - 0.3$).

Of the ten female hemophiliacs, four died during the first 2 weeks of life. One died of massive hemorrhage, one died accidentally, and two died of undetermined causes not associated with hemorrhage. The remaining six animals vary in age from 2 to 10 months. They were raised under conditions similar to those described previ-

[1] This investigation was supported in part by a research grant from the Division of Research Grants and Fellowships, National Institutes of Health, U. S. Public Health Service.

[2] Markle Scholar in Medical Science.

TABLE 1

PROGENY FROM MATINGS OF FEMALES HETEROZYGOUS FOR HEMOPHILIA WITH HEMOPHILIC MALES*

Litter No.	Pups in litters		Females		Males	
	Total No.	No. tested	Hemophiliacs	Nonhemophiliacs	Hemophiliacs	Nonhemophiliacs
1	15	5	2	0	2	1
2	9	8	2	1	1	4
3	11	11	1	4	2	4
4	9	7	0	3	1	3
5	7	6	4	0	1	1
6	7	4	1	1	1	1
Total	58	41	10	9	8	14

* Four dams and two sires were used in these matings. Two dams had two litters each; litters 2 and 5 were from one dam, litters 3 and 6 from another dam. Animals not tested were either stillborn or died during the first 2 days of life. In litter 1, dam suffered from dystocia, and only the first few pups were viable.

ously (*3*). All of them have suffered from many hemorrhagic episodes, particularly hemarthroses and subcutaneous hemorrhages. The joint hemorrhages have recurred frequently, and in the two oldest animals permanent joint deformities have resulted. Repeated transfusions of normal plasma, in amounts varying from 2 to 4 ml/kg body weight, have served to control the hemorrhagic manifestations, and no animal thus treated has died.

TABLE 2

CLOTTING STUDIES ON FEMALE BLEEDER DOGS*

Dog No.	Clotting time (Lee-White)	Bleeding time (mucous membrane)	Prothrombin utilized during 1st	Clotting time 15 min after transfusion
	min	min	%	min
1	70	2½	0	9
2	61	1½	2	..
3	56	2	0	7½
4	60	2	0	6
5	120	2	0	8
6	110	1½	0	7
Normal Control	5½	1¾	>90	..

* Methods used in these tests were described previously (*3*). Transfusions consisted of normal citrated dog plasma given in a dose of 3 ml/kg body weight.

Table 2 shows the results of one group of clotting studies on the female bleeder dogs. All of these animals showed prolonged clotting time, normal bleeding time, delay in prothrombin utilization in shed blood, and a normal or nearly normal clotting time following transfusions of normal plasma. These findings, along with other studies, indicate that the female bleeders differ only in sex from the hemophilic male dogs previously described (*3*). Like human hemophiliacs (*1*), they appear to be deficient in a plasma factor required for platelet utilization and mobilization of thromboplastin.

As far as can be determined, these animals are the first cases of true hemophilia in the female. That the genotype X_hX_h is not a lethal combination, at least in dogs, is of considerable interest. Indeed, the close approximation of the observed incidence to the expected incidence of this genotype suggests that there is no tendency toward prenatal lethality. Our findings suggest that the lack of female hemophilia in humans is due to the paucity of matings between female heterozygotes and hemophilic males.

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Diabetogenic Effect of Dehydroglucoascorbic Acid[1]

John W. Patterson

Department of Anatomy, School of Medicine, Western Reserve University, Cleveland

Dehydroascorbic and dehydroisoascorbic acids have been shown to produce diabetes (*7*, *8*). They are believed to be the only substances of known chemical structure, other than compounds related to alloxan, that will produce lasting diabetes after administration of a few doses. It seemed important to investigate the possible diabetogenic action of related compounds. Therefore, diketogulonic and dehydroglucoascorbic acids were selected for study in rats.

Diketogulonic acid was obtained by permitting dehydroascorbic acid, prepared by the oxidation of L-ascorbic acid with quinone (*8*), to mutarotate at room temperature for 14 days (*10*). Just before injection into the rat, the acid was neutralized to pH 6.7 with 2*N* NaOH. Neutralization required one equivalent of alkali. The product is stable at this pH (*2*). Dehydroglucoascorbic acid was prepared by oxidation of D-glucoascorbic acid[2] with quinone as previously described (*8*).

Six male rats of the Sprague-Dawley strain, ranging in weight between 98 and 130 g, were given intravenously 17.7 millimoles of diketogulonic acid per kg following 48 hr of starvation. The rats showed no hyperactivity, lacrimation, or increased salivation after the injection. Blood sugars were determined on six occasions during the 2 weeks following injection, and there was no hyperglycemia in any of the animals. The rats gained weight normally during this period.

Another series of male rats of the Sprague-Dawley strain were injected intravenously with dehydroglucoascorbic acid following 48 hr of starvation. After the injection there was no hyperactivity, lacrimation, or increased salivation. With a dose of 8.5 millimoles per kg,

[1] Aided in part by a grant from The Permanent Science Fund of the American Academy of Arts and Sciences.

[2] Samples were generously supplied by Dr. H. G. Luther of Chas. Pfizer & Co.; Dr. P. P. Gray of Wallerstein Laboratories; and Dr. A. Welch of the Pharmacology Department, Western Reserve University.

TABLE 1

DIABETOGENIC ACTION OF INTRAVENOUS INJECTIONS OF DEHYDROGLUCOASCORBIC ACID IN MALE RATS

No. of rats	Wt (in g)		Dehydro-gluco-ascorbic acid milli-moles/kg	Avg blood sugar in mg/100 ml blood							
				Before injection	After injection						
	range	avg			2–3 days	3–4 days	1 week	2 weeks	3 weeks	4 weeks	5 weeks
6	110–130	122	8.5*	122	107	114	126	124	—	—	—
5	119–132	123	11.4*	121	119	160	122	121	—	—	—
3	116–126	120	17.0	55	386	219	112	113	—	—	—
1	—	111	17.0	57	430	450	350	358	450	450	395
4	102–128	114	17.9	89	346	217	162	117	—	—	—
2	95–120	108	18.5	98	335	269	291	115	—	—	—
1	—	108	18.5	80	540	450	450	525	900	900	540
1	—	120	18.5	82	450	665	385	340	282	370	352
1	—	128	18.5	99	450	315	410	437	300	437	415
1	—	102	19.3	91	330	146	113	118	—	—	—
1	—	113	19.3	118	463	450	480	425	800	640	565

* Starved 24 hr; all others starved 48 hr before injection.

no hyperglycemia was noted. With a dose of 11.4 millimoles per kg, a slight transient hypergylcemia resulted. With doses between 17.0 and 19.3 millimoles per kg, five of the rats developed a hyperglycemia that persisted for a minimum of 5 weeks. Other rats developed transient hyperglycemias. Doses greater than 20.0 millimoles per kg were fatal. Blood sugars were determined by a micromethod (*1*). The results are summarized in Table 1.

The product resulting from mutarotation of dehydroascorbic acid is thought to be diketogulonic acid (*2, 9, 11*), which results from the opening of the lactone ring. This substance is stable in acid solutions and in slightly alkaline solutions (*2*). In the concentration used in this experiment, which is over twice the diabetogenic dose of dehydroisoascorbic acid, diketogulonic acid did not have any diabetogenic properties. The fact that the ring form, dehydroascorbic acid, has about the same diabetogenic potency as dehydroisoascorbic acid (*3*) would suggest that a ring structure is essential for the production of diabetes. This is in keeping with the finding that derivatives of mesoxalic acid, which is a constituent of the alloxan ring, are also inactive (*3, 4, 6*).

The dehydro derivative of D-glucoascorbic acid differs from the corresponding derivatives of L-ascorbic and D-isoascorbic acids in that the configuration of the asymmetric carbon involved in ring formation is of the opposite type, and in that there is an extra carbon on the side chain. It is also different in that it has no physiological activity in scorbutic animals (*12*). Its ability to produce what appears to be permanent diabetes in rats indicates that the configuration of the asymmetric carbon which is involved in ring formation is not a determining factor for diabetogenic action. The fact that it is necessary to use over twice as much of the glucoascorbic acid derivative as was necessary with the derivative of isoascorbic acid (*3*) may not be related to the relative action of these compounds at the site of diabetes production, but may be only a reflection of some factor such as permeability. It is known that glucoascorbic acid is not concentrated in the fluid of the anterior chamber of the eye, whereas ascorbic and isoascorbic acid are concentrated there equally well (*5*). If this reasoning may be extended to the dehydro forms of these compounds, it would be in keeping with the idea that permeability may be the factor responsible for the larger dose requirement of dehydroglucoascorbic acid.

Since diabetes can be produced from the dehydro derivatives of L-ascorbic, D-isoascorbic, and D-glucoascorbic acids but not from diketogulonic acid, it is evident that the ring is important in the production of diabetes. By analogy with alloxan, the three adjacent carbonyl groups are also important. The configurations of the asymmetric carbons do not appear to be determining factors in the diabetogenic action of these compounds. It is hoped that it will be possible to test some substance such as the dehydro form of reductic acid to determine whether the hydroxyl groups may be of importance in the production of diabetes.

The lack of hyperactivity, lacrimation, and increased salivation following the injection of diketogulonic and dehydroglucoascorbic acids, neither of which has any antiscorbutic activity, again suggests that the finding of these symptoms following the injection of dehydroascorbic and dehydroisoascorbic acids is a reflection of a possible biochemical function of ascorbic acid (*8*).

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Comments and Communications

Otto Struve on the Freedom of Science

As retiring president, Otto Struve addressed the American Astronomical Society at its meeting in Tucson, Arizona last December. His opening remarks, from which excerpts are quoted here, have far-reaching implications for all scientists:

The American Astronomical Society has increased greatly in stature and in membership since its beginning in 1897. . . . We now face problems which were unknown to our predecessors; to cope with them we shall need to draw upon the combined wisdom, experience, and good will of all the members of our Society. . . . The three years of my presidency have been a period of postwar reconstruction in astronomy and reappraisal of our efforts. As physical scientists we are affected by the soul-searching doubts of the atomic scientists, and as the representatives of the most international among the sciences we are disturbed by the growth of narrow nationalism in science. Political considerations unknown to our founders and abhorred by our immediate predecessors have been thrust upon us by those who wish to make of science a tool for advancing their own ideologies. Some of the developments represent real dangers, and I should like to direct the attention of the society and of our new president to three issues:

The first danger comes from without. Recently, attacks made upon us by astronomers of the Soviet Union, combined with boastful assurances of their own preeminence, have filled many of our members with deep concern. We are portrayed as ruthless stooges of a capitalistic conspiracy to enslave the world, who deal out incorrect scientific information in order "to prove the futility of life on earth and to disarm the will of the people to change the existing order." We are accused of medieval faith and an "idealistic" outlook by those who profess to serve only the dictates of pure materialism.

The second danger comes from within. It is disheartening that a famous foreign astronomer who was invited to work at an American observatory was refused a visa by our State Department without any explanation of its action to the institution that invited him. By acts of this nature, the interests of science are defeated, American prestige is lowered, a potential friend of our democracy may very well have been turned into an enemy, and a suspicion is created that political attempts to control scientific thought are not all confined to countries on the other side of the Atlantic.

The third danger lies within ourselves. It is all too easy, step by step, to relinquish our freedom of scientific inquiry and to surrender to political powers our right to control our thought. Fear of political persecution and of social ostracism are cropping up in unexpected places. We must remain united as never before; we must not allow our differences to blind us to the dangers I have referred to. We should reaffirm our belief in the freedom of science.

The full text of Dr. Struve's address was published in the January issue of *Popular Astronomy*.

COUNCIL OF THE AMERICAN ASTRONOMICAL SOCIETY
C. M. HUFFER, SECRETARY

Washburn Observatory
Madison, Wisconsin

Unesco and the IUPAP

Marcel Schein's report on the Como Conference on Cosmic Radiation (*Science*, 1950, **111**, 16) states:

The conference was organized by the Italian Physical Society, under the sponsorship of the International Union of Physics (Unesco) whose president, H. A. Kramers (Holland), originally suggested the idea of holding an International Colloquium on Cosmic Rays this year.

This statement seems to indicate that the International Union of Physics is a part of Unesco. Since such a misunderstanding occurs quite often, I should like to take this opportunity to make clear the relation between Unesco and the International Union of Pure and Applied Physics.

The International Union of Pure and Applied Physics (IUPAP) is an independent international nongovernmental scientific organization. It has been federated in the International Council of Scientific Unions (ICSU) ever since this council was organized in 1931. Besides IUPAP, nine other unions (in the following fields of science: astronomy, scientific radio, crystallography, theoretical and applied mechanics, pure and applied chemistry, geography, geodesy and geophysics, biological sciences, and history of science) are federated in ICSU. The council signed a formal agreement with Unesco in December 1946, under the terms of which the council and its unions on one hand, and Unesco on the other, consult each other on and render help to each other in matters concerning international cooperation in the field of basic sciences. The formal agreement makes the council, its unions, and their subsidiary organizations eligible for grants-in-aid from Unesco. However, the council, its unions and their subsidiary organizations are independent organizations which do not form part of Unesco.

In the case of the International Symposium on Cosmic Rays, which was held at Como last year, and also in that of the International Symposium on Nuclear Physics which preceded the Symposium on Cosmic Radiation, Unesco allocated the following grants-in-aid to IUPAP: for the Symposium on Cosmic Rays—transportation expenses, 14 persons, $1,850; publications, $400; for the Symposium on Nuclear Forces—transportation expenses, 10 persons, $2,150; publications, $400.

P. AUGER

Director, Department of Natural Sciences,
Unesco, Paris

Correction

The article "Antifolliculoid Activity of Vitamin A" (Kahn, Raymond H. and Bern, Howard A., *Science*, 1950, **111**, 516) contains an error. The words ". . . and inactivate," at the end of the first line, paragraph 2, p. 516, should be deleted.

HOWARD A. BERN

University of California

NEWS and Notes

Edmund W. Sinnott, past president of the AAAS, has been appointed dean of the Graduate School at Yale University. He will continue to serve as director of the Sheffield Scientific School, but is retiring as chairman of the Department of Plant Science. He will be succeeded in his post by **Paul R. Burkholder,** Eaton Professor of Botany.

John Ray Dunning, professor of physics at Columbia University and scientific director of Columbia's new cyclotron at Irvington-on-Hudson, New York, has been appointed dean of the School of Engineering. Dr. Dunning succeeds **James K. Finch** who retired June 30. Dean Finch will resume the chair of the Renwick Professor of Civil Engineering, which he formerly held.

Helmut R. Gutmann, of the College of Medicine, University of Tennessee, has been appointed assistant research professor and biochemist in the Cancer Research Laboratory of the University of Florida.

William C. Steere, head of the Department of Botany at the University of Michigan and editor-in-chief of the *Bryologist*, will join the Stanford University faculty in September as professor of botany. Prof. Steere will succeed **Gilbert Morgan Smith,** who retires this year.

George M. Jemison has been appointed director of the Northern Rocky Mountain Forest and Range Experiment Station, U. S. Forest Service, Missoula, Montana. Dr. Jemison, formerly chief of the Division of Forest Management Research at the Southeastern Forest Experiment Station at Asheville, North Carolina, succeeds **C. L. Tebbe,** who is transferring to the Washington, D. C., office of the Forest Service.

Athelstan Spilhaus, dean of the University of Minnesota's Institute of Technology, has been named deputy chairman of the Committee on Geophysics and Geography of the Research and Development Board, Department of Defense, to succeed **W. W. Rubey,** of the U. S. Geological Survey. Dr. Spilhaus, who has served as an alternate member since the committee's formation in December, 1948, is one of five civilian members.

Pierre Dansereau, of the Service de Biogéographie, University of Montreal, has been appointed assistant professor in the Department of Botany of the University of Michigan. **Stanley A. Cain** was named Charles Lathrop Pack Foundation Professor of Conservation in the university's newly created School of Natural Resources.

Paul M. Erlandson, a specialist on guided missile and antisubmarine instruments, has been appointed chairman of Southwest Research Institute's Physics Department. Dr. Erlandson was formerly with the Research and Design Branch of the Electronics Division, Navy Bureau of Ships, and the Defense Research Laboratory of the University of Texas.

Visitors to U. S.

Alfred Katz, of the Pharmaceutical Institute, University of Basel, has been invited to work as special fellow with the Experimental Biology and Medicine Institute of the National Institutes of Health, Bethesda, Maryland. He is conducting analytical work with tropical plant material, and collaborating in research problems in the field of steroidal natural products.

Recent visitors at the National Bureau of Standards were **Claude M. Brooke,** Swiss research fellow with the Belgian Inter-Universities Institute for Nuclear Physics at Mons; **Juan D. Lopez Gonzales,** of the University of Granada and member of the Consejo Superior de Investigaciones Científicas, Spain; **G. N. Holmes,** of the British Society for Aircraft Construction, and **G. Weston,** assistant manager, British Standards Institution, Great Britain; **Mario Lewy,** head of the Chemistry Department, Centro Nacional de Agricultura, San Salvador; **Hiroshi Sho,** chief, Documents Section, Radio Regulatory Commission, Tokyo; and **Jacobus W. Swardt,** principal scientific officer and head of the Engineering Division, South African Bureau of Standards, Pretoria.

Henrik Ortenbland, director of the Swedish Government Printing Office, and **Gunnar Hedlund,** hydrographer of the Royal Swedish Marine Chart Service, recently visited the U. S. Geological Survey.

Grants and Awards

The National Research Council has announced awards for 1950–51 under six programs of fellowships which it administers. National Research Fellowships in the natural sciences, supported by the Rockefeller Foundation, were awarded to these 17 recent recipients of the doctorate, for further research training at the following institutions: *Gordon M. Barrow,* Oxford University; *Harry A. De Walt, Jr.,* University of Wisconsin; *Erwin L. Hahn,* Stanford University; *Alex Heller,* Institute for Advanced Study; *Lyle V. Jones,* University of Chicago; *Richard V. Kadison,* Institute for Advanced Study; *Walter Kohn,* Eidg. Technische Hochschule, Zurich; *David R. Layzer,* University of Michigan; *John M. Mays,* Harvard University; *Alan L. McClelland,* University of Birmingham, England; *Harden M. McConnell,* University of Chicago; *Floyd Ratliff,* Johns Hopkins University; *Maxwell A. Rosenlicht,* Princeton University; *Burton S. Rosner,* Yale University; *Robert V. Ruhe,* State University of Iowa; *Charles M. Wilson,* University of California; *Barbara E. Wright,* Physiological Institute, Copenhagen. The fellowship of *Verne Grant,* Carnegie Institution of Washington, Stanford University, was renewed.

Merck Postdoctoral Fellowships, supported by Merck and Company, to help recipients to achieve productive competence in both chemistry and biology were awarded to: *Laurens Anderson,* Eidg. Technische Hochschule, Zurich; *William A. Atchley,* Rockefeller Institute for Medical Research; *Robert E. Taylor,* University of Chicago; *James D.*

Watson, University of Copenhagen, Denmark. Renewal appointments were granted to *Melvin Cohn*, Institut Pasteur, Paris; *Ruth Sager*, Rockefeller Institute for Medical Research; and *Robert C. C. St. George, Jr.*, California Institute of Technology.

Nine awards of the RCA Fellowships in Electronics were also announced. These predoctoral fellowships, supported by the Radio Corporation of America, are for graduate training of young men and women in the general field of electronics. Newly appointed fellows are: *George E. Zenk*, Carnegie Institute of Technology; *John G. Meeker*, University of Michigan; *Gene W. Zeoli* and *Andrew R. Hutson*, Massachusetts Institute of Technology; and *Hillard M. Wachowski*, Northwestern University. Renewal appointments for another year were granted to: *Charles K. Birdsall* and *David Carter*, Stanford University; *Gerald Estrin*, University of Wisconsin; and *Fumio Robert Naka*, Harvard University.

Postdoctoral Research Fellowships in the Medical Sciences, supported by the Rockefeller Foundation, were granted for 1950–51 to: *Evan Calkins*, Harvard University; *Sam L. Clark, Jr.*, Vanderbilt University; *Norman A. Coulter, Jr.*, Johns Hopkins University; *James G. Kirsch*, Rockefeller Institute for Medical Research; *Charles A. M. Hogben*, Laboratory of Zoophysiology, Copenhagen; *Irving G. Kagan*, University of Chicago; and *Edward D. Thomas*, Massachusetts Institute of Technology. Renewal appointments for second year were granted to: *Richard J. Cross*, Public Health Research Institute of the City of New York; *Marion E. Lahey*, University of Utah; *Alexander Leaf*, Massachusetts General Hospital; *John B. Neilands*, Medicinska Nobelinstitutet, Stockholm; and *Alexander Rich*, California Institute of Technology.

Research fellowships in fields related to poliomyelitis, administered by the NRC on behalf of the National Foundation for Infantile Paralysis, Inc., were awarded to: *Robert M. Chanock*, University of Cincinnati; *Franklin A. Neva*, Harvard University; and *William F. Scherer*, University of Minnesota. A senior fellowship in poliomyelitis was awarded to *Edgar A. Bering, Jr.*, Peter Bent Brigham Hospital and Children's Hospital, Boston.

Under the program of Fellowships in Anesthesiology, supported by the American Society of Anesthesiologists, Inc., an appointment was made to *Elizabeth J. Crawford*, Bellevue Hospital, New York, for research at that institution under E. A. Rovenstine.

The Keyes Memorial Medal of the American Association of Genito-Urinary Surgeons was presented to Herman L. Kretschmer, of Chicago, at the meeting of the association in Hershey, Pennsylvania.

The Donald E. Barr Memorial Fellowship has been awarded to Glen R. Gale by the American Trudeau Society, a division of the National Tuberculosis Association. Gale, a 20-year-old Duke University student who last year gained recognition through discovery of a new fungus-killer, will continue research in microphysiology at the university.

John Henry McClement, of the College of Physicians and Surgeons of Columbia University, has been awarded the first **James Alexander Miller Fellowship for Research in Tuberculosis**, by the New York Tuberculosis and Health Association.

Research Opportunities

The American Heart Association, as part of its research program, has established **career investigatorships for research in cardiovascular problems.** Investigators will be chosen from the age group of 35 to 45 years. They will work independently on research of their own choosing, in any institution in the U. S. providing adequate facilities, and may move from one institution to another, spending brief periods abroad. The selection of the place of work will be subject to approval by the American Heart Association. No more than 15 percent of an investigator's time will be spent in teaching, and no administrative duties will be required. Annual reports of work accomplished must be sent to the medical director of the association. The minimum annual stipend for the career investigator will be $12,000, a maximum of $7,500 will be available for technical help, services, and supplies, and in addition, the investigator may apply for grants-in-aid from any organization, including the association. It is the intention of the association to support investigators in research until the age of 65, when they will be under the association's retirement plan. Requests for nominations or for further information should be sent to the Scientific Council of the American Heart Association, 1775 Broadway, New York City, to deans of medical schools, or to heads of research units. The number chosen will depend on the income of the association.

A research fellowship in endocrinology has been established recently at Rutgers University by Schering Corporation, pharmaceutical manufacturers of Bloomfield, New Jersey. The grant, valued at $2,300, is for the support of fundamental research by graduate students in the field of steroid hormones and will facilitate study of several important problems, including the relationship between normal steroid hormone functions and the protein metabolism of the body. Further information may be obtained from Perry L. Stucker, Advertising Manager, Schering Corporation, Bloomfield, New Jersey.

Summer Programs

A course in **modern industrial spectrography,** for chemists and physicists in industry and for graduate and advanced undergraduate students, will be held at Boston College, July 24–August 4. The course of lectures, laboratory work, and discussion periods will carry no credit, but students will have the opportunity for experience in their particular fields. Tuition for the course is $100. Admission is limited to 40, and applications will be accepted in order of receipt. Applications and further information can be obtained from James J. Devlin, S.J., Physics Department, Boston College, Chestnut Hill 67, Massachusetts.

A conference on the teaching of chemistry, sponsored by Michigan State College Chemistry Department, will be held August 22–25 in the Kedzie Chemistry Laboratory on the college campus. Teachers at both the high school and college levels are invited to attend and to bring their families. The registration fee is $2.50; nonprofessional guest fee, $1.00; housing and meals at Shaw Hall, Tuesday through Friday, $12.75. Further information may be obtained from K. G. Stone, Kedzie Chemistry Laboratory, Department of Chemistry, Michigan State College, East Lansing, Michigan.

A course in **instrumentation for radioisotope work** will be conducted by the Special Training Division of the Oak Ridge Institute of Nuclear Studies, September 5–15. The course, which is limited to 40, will be open to chemical instrument specialists, electrical engineers, physicists, and others specializing in instrumentation. Morning sessions will be devoted to formal discussion of specific topics and afternoon sessions will include informal group discussions. A fee of $25 is charged for the course. Participants will pay their own living and traveling expenses. Additional information and application blanks may be obtained from Ralph T. Overman, Chairman, Special Training Division, Oak Ridge Institute of Nuclear Studies, P. O. Box 117, Oak Ridge, Tennessee.

Industrial Laboratories

Televised surgical operations and clinical procedures will be viewed this summer in five Latin American countries through a joint arrangement between **E. R. Squibb and Sons International Corporation** and the **International General Electric Company, Inc.** "Video Medico" will be demonstrated at the Brazilian Congress of Gastro-Enterology, to be held in São Paulo, and at the Congress of International College of Surgeons, Buenos Aires. Demonstrations will also take place at San Juan, Puerto Rico, Caracas, Venezuela, and Mexico City. Programs demonstrating adaptability of television to educational, civic, health, and religious training will also be presented in each country.

General Mills Research Laboratories has appointed Robert J. Foster head of its Chemical Engineering Department in Minneapolis. Dr. Foster joined the laboratories' staff in 1943.

Meetings and Elections

Two international syphilis seminars will be held in Helsinki and Paris this fall under the auspices of the World Health Organization, for the promotion of exchange of information on the prevention, diagnosis, and treatment of syphilis. Participants will review the results of the World Health Organization-United Nations International Children's Emergency Fund campaigns against congenital syphilis through penicillotherapy. These campaigns are now under way or in preparation in many countries of Europe, Asia, America, and the Eastern Mediterranean. The Helsinki seminar, to be held September 4–10, will include specialists from Denmark, Iceland, Norway, Sweden, the United States, and Finland. The Paris meeting, September 25–October 7, will include specialists from Belgium, Greece, Ireland, Italy, Luxembourg, The Netherlands, Portugal, United Kingdom, United States, Switzerland, Yugoslavia, and France.

The Fifth Calorimetry Conference will meet September 5 at the Technological Institute of Northwestern University. Full details of the conference may be obtained from Daniel R. Stull, Physical Research Laboratory, Dow Chemical Company, Midland, Michigan.

A conference on differential equations will be held September 8–9 at the University of Maryland. The conference is under the sponsorship of the university's Institute for Fluid Dynamics and Applied Mathematics and the Department of Mathematics. Speakers will include M. Morse, Institute for Advanced Study, Princeton; N. Aronszajn, Oklahoma Agricultural and Mechanical College; J. Leray, Collège de France, Paris; J. Hadamard, Institut de France, Paris; M. Picone, Istituto Nazionali per le Applicazioni del Calcalo, Rome; and M. Martin and A. Weinstein, both of the University of Maryland. Those planning to attend the conference should advise Prof. J. L. Vanderslice, Department of Mathematics, University of Maryland, College Park, Maryland not later than *August 1*. There will be no registration fee.

The American Oil Chemists' Society will hold its fall meeting at the Sir Francis Drake Hotel in San Francisco, September 26–28. Further information may be obtained from the general chairman, E. B. Kester, Western Regional Research Laboratory, Albany, California.

The 1950 sessions of the **Gulf and Caribbean Fisheries Institute** have been scheduled for November 6–10 at the Sans Souci Hotel, Miami Beach, Florida. In response to a number of requests, a special concurrent one-day session has been scheduled for November 6, in order to allow presentation of papers dealing with the basic oceanography and marine biology of the Gulf of Mexico and the Caribbean. Those wishing to present papers in these fields unrelated to fisheries, as well as in the field of fisheries, should write before *July 30* to the Director, Marine Laboratory, University of Miami, Coral Gables, Florida.

The American Electroencephalographic Society at its annual meeting, June 10–11, elected the following officers for the ensuing year: president, Robert S. Schwab, Massachusetts General Hospital; vice president, James L. O'Leary, Washington University School of Medicine; treasurer, Mary A. B. Brazier; and secretary, John A. Abbott, both of Massachusetts General Hospital.

A national conference on premedical education, sponsored by Alpha Epsilon Delta in cooperation with the Association of American Medical Colleges, will be held at the Lake Placid Club, Essex County, New York, October 21–22, preceding the annual meeting of the association, October 23–25. The conference will be organized as a workshop of

round-table discussion groups of medical and premedical educators. The meetings are being arranged under the direction of Hugh E. Setterfield, national president of Alpha Epsilon Delta and professor of anatomy, Ohio State University College of Medicine. Further information may be obtained by writing to Alpha Epsilon Delta, 303 Upland Road, Havertown, Pennsylvania.

The American Society of Plant Taxonomists elected the following officers for 1950–51: president, Lincoln Constance, professor of botany, University of California at Berkeley; secretary, Reed C. Rollins, director of the Gray Herbarium, Harvard University; treasurer, Robert Foster, Gray Herbarium, Harvard; president of the council, W. H. Camp, Academy of Natural Sciences of Philadelphia.

The Nebraska Academy of Sciences at its annual meeting elected the following officers for 1950–51: president, Otis Wade, University of Nebraska; vice president, S. B. Shively, Nebraska Wesleyan University; secretary, C. B. Schultz, University of Nebraska; treasurer, C. E. Rosenquist, University of Nebraska.

Deaths

Juan José Osuna, a member of the AAAS since 1927 and a fellow since 1934, died in Arlington, Virginia, on June 18. Born in Puerto Rico in 1884, Dr. Osuna received his education at Pennsylvania State College and Columbia University. He served as dean of the College of Education, University of Puerto Rico, for many years. His book, *The History of Education in Puerto Rico,* was published three months before his death.

James Ellsworth Boyd, professor emeritus of mechanics at Ohio State University, died in Columbus, May 10, after a long illness. He was 86. Prof. Boyd was the first chairman of the Department of Mechanics, and served there from 1906 to 1934.

John Salem Lockwood, 42, professor of surgery at Columbia University's College of Physicians and Surgeons, died June 16. Dr. Lockwood, who had done early research in the sulfa drugs, had recently been appointed clinical director and chief of surgical services of Memorial Hospital's Center for Treatment of Cancer and Allied Diseases in New York City.

William Freeman Snow, 74, a specialist in public health and preventive medicine, died June 12, in Bangor, Maine, near his summer residence. Dr. Snow, a special consultant to the U. S. Public Health Service since 1936, was a founder and chairman of the American Social Hygiene Association.

Walter C. Preston, research chemist, died June 12, in Cincinnati, at the age of 54. Dr. Preston, who had been associated with Procter and Gamble Company since 1923, was known for his development of silica gel as a drying agent.

The collection of Foraminifera willed to the U. S. National Museum by the late Joseph A. Cushman has been combined with the museum collection to facilitate use of the material for study. The Cushman collection comprises over 4,000 books and reprints, a card catalog of 98,000 species, and 175,000 study slides.

The Australian Journal of Marine and Freshwater Research has been established by the Commonwealth Scientific and Industrial Research Organization for publication of research papers on results of original investigations on sea, estuarine, and freshwater fisheries, and related subjects. N. S. Noble, of the organization's staff, has been appointed editor of the new journal, which will be issued as the accumulation of material dictates—possibly biannually. The first number has been published and orders should be addressed to the Secretary, CSIRO, 314 Albert Street, East Melbourne, C.2. The subscription rate is 7/6 per issue.

A section on the chemistry of natural products has been established at the research laboratories of the **National Heart Institute** of the National Institutes of Health. Evan C. Horning, associate professor of chemistry at the University of Pennsylvania, has been appointed to head the new section.

Botanical Nomenclature and Taxonomy, a symposium organized by the International Union of Biological Sciences in cooperation with Unesco, and edited by J. Lanjouw, of the University of Utrecht, has been published by *Chronica Botanica.* It includes a supplement of alterations made in the International Rules of Botanical Nomenclature at the 56th International Congress. Another supplement deals with the possibilities of an international association of taxonomic botanists (see *Science,* March 17, p. 294) to be established during the Stockholm Congress next month. The symposium, priced at $2.50, can be ordered from the Chronica Botanica Company, Waltham, Massachusetts, or from Stechert-Hafner, Inc., New York City.

Recently Received—

Preservation of Agricultural Specimens in Plastics. G. R. Fessenden. U. S. Department of Agriculture, Publ. 679. U. S. GPO, Washington 25, D. C.

Tables of Confluent Hypergeometric Function $F(\frac{n}{2}, \frac{1}{2}; x)$ ***and Related Function.*** National Bureau of Standards Applied Mathematics Series 3. U. S. GPO, Washington 25, D. C. 35 cents.

Spectrophotometry (200 to 1,000 millimicrons). Kasson S. Gibson. National Bureau of Standards Circ. 484. U. S. GPO, Washington 25, D. C. 25 cents.

Catalog of Termites of the World. Thomas E. Snyder. Smithsonian Institution, Washington 25, D. C.

Genetic-Statistical and Psychiatric Investigations of a West Swedish Population. Torsten Sjögren. Ejnar Munksgaard, Norregade 6, Copenhagen, Denmark.

Netherlands Export Book Catalog, 1950. Book and Periodical Export Center, Amsterdam, Netherlands. Unesco coupons accepted.

University of Michigan Museums Report, 1947–48. University Press, Ann Arbor, Mich.

Personnel Placement

CHARGES and REQUIREMENTS for "PERSONNEL PLACEMENT" Ads

1. Rate: 15¢ per word, minimum charge $3.00 for each insertion. If desired, a "Box Number" will be supplied, so that replies can be directed to SCIENCE for immediate forwarding. Such service counts as 8 words (e.g., a 25-word ad, plus a "Box Number", equals 33 words). All ads will be set in regular, uniform style, without display; the first word, only, in bold face type.

For *display* ads, using type larger or of a different style than the uniform settings, enclosed with separate border rules, the rate is $16.00 per inch; no extra charge for "Box Numbers".

2. Advance Payment: All Personnel Placement ads, *classified* or *display*, must be accompanied by correct remittance, made payable to SCIENCE. Insertion can not be made until payment is received.

3. Closing Date: Advertisements must be received by SCIENCE, 1515 Mass. Ave., N.W., Washington 5, D. C., together with advance remittance, positively not later than 14 days preceding date of publication (Friday of every week).

POSITIONS WANTED

Academic Position, Head of Department, desired by organic-biochemist Ph.D., with broad training in related fields. An experienced enthusiastic teacher, interested in research, would enjoy an active role in a growing institution. Highly recommended, Age 44. Box 206, SCIENCE. 6/30

Botanist: M.S., desires position, teaching, research; teaching experience, botany, biology; industrial experience, dairy bacteriology, plant propagation. Box 217, SCIENCE. X

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Microbiologist-Bacteriologist: Ph.D., 33, eleven years' responsible teaching and investigation, two post-doctoral fellowships, desires university position. Minimum $6000. Box 200, SCIENCE. R6/30

Parasitologist; M.S. degree; considerable work toward Ph.D.; nine years' experience in various scientific fields along administrative lines; for further information, please write Burneice Larson, Medical Bureau, Palmolive Building, Chicago. X

Physiologist: Ph.D., Enzyme-cytochemistry, 3 years teaching experience, biology, physiology, desires teaching or research position. Box 219, SCIENCE. X

Zoologist: Experienced college teacher desires change, research opportunity. Several years successful teaching. Ph.D. Former National Research Council Fellow. Research publications in ecology. Interested in teaching, museum, research, or library position. Box 215, SCIENCE. 7/14

POSITIONS OPEN

Positions Open:
(a) **Medical bacteriologist** and virologist to join faculty of department of pathology; university college of medicine; physician or candidate with Ph.D. required. (b) **Physicist;** group clinic specializing in radiology; university medical center; West. (c) **Endocrine research chemist** capable of doing endocrine assays; 18-man clinic operating own hospital of fairly large size; university affiliations; East. (d) **Instructor,** radiographic technique; science major, teaching and research experience required; department, radiology, university medical school; $4800. (e) **Microbiologist;** Ph.D., fundamental training in fermentations, soils and allied biochemistry required; research appointment; California. (f) **Assistant production manager,** biological manufacturing company; Master's degree in pharmacy or pharmaceutical chemistry desired. (g) **Editorial assistant;** biologist with minimum B.S. degree, Master's preferred; large pharmaceutical company, Middle West. (h) **Bacteriologist,** Ph.D. agricultural college; duties consist of six months' teaching, six months' research. (i) **Young man** with background in chemistry qualified to serve as executive in advertising agency handling accounts several large chemical companies: $10,000. S6-5 Burneice Larson, Medical Bureau, Palmolive Building, Chicago. X

The Market Place

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2. Payment: For all *classified* ads, payment in advance is required, before insertion can be made. Such advance remittances should be made payable to SCIENCE, and forwarded with advertising "copy" instructions. For *display* advertisers, monthly invoices will be sent on a charge account basis—providing satisfactory credit is established.

3. Closing Date: Classified advertisements must be received by SCIENCE, 1515 Massachusetts Avenue, N.W., Washington 5, D. C., together with advance remittance, positively not later than 14 days preceding date of publication (Friday of every week).

For proof service on display ads complete "copy" instructions must reach the publication offices of SCIENCE, 1515 Massachusetts Avenue, N.W. Washington 5, D. C., not later than 4 weeks preceding date of publication.

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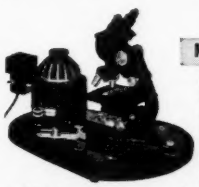

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